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Title: NUMERIC AND AUTOMATIC MAPS FOR THE CATALOGUING OF ARTISTIC AND HISTORIC URBAN HERITAGE

Abstract: Cartography at very large scale gives operative advantages in planning, preserving and cataloguing artistic and historic urban heritage. Experience on the historic site at Montagnana in cartographic processes at 1:200 scale gave rise to new problems of executive method and has opened such branches of research as to deserve deeper studies.

The 1:200 scale for urban maps constitutes the link between classical mapping and the complex of the data processing and surveys, at larger scales, of architecture. The former is regulated by precise norms of execution and control, while the latter are generally entrusted to the individual technical and critical capacities of their makers. Whatsmore, the urban and territorial maps offer a metric and descriptive synthesis of a great number of complex and articulated spatial situations; while the architectural surveys deal separately with the field of "single" phenomena in architecture.

The maps at 1:200 scale also fulfil some specific requirements which characterize them: they are essentially operative maps, tools directly used in urban planning and architectural drafting. This is true not only to the extent at which they supply extremely detailed and precise data, but also because they allow to bypass the exclusively planimetrical representations, as it happens with classical mapping and permit the construction of urban sections and elevations opening new fields of research and processing.

The last point confirms and improves the instrumental content of these maps for drafting use, but at the same time opens interesting aspects for methodological coordination and unification between urban and architectural survey programs.

We omit in this brief essay an analysis of those operative aspects which are connected to the technique of drafting, not because they are of negligible importance, but as they are intuitively understandable and closer to the experience of most technicians. Urban planning and detailed zoning programs, the restoring and restructuring of historic urban centers, the projects for large urban services (i.e. schools, hospitals, cultural and administrative centers, etc.) as well as the planning of public transportation systems, are all operative aspects which clearly illustrate

the utility of 1:200 scale maps.

On the other hand we intend to aim at going into a larger detail in the method of producing extra-large scale maps and in particular the use of 1:200 scale maps for the conservation of the artistic and historic heritage of the city, while suggesting a hypothesis which includes architectural surveys in urban mapping.

The conservation of artistic and historic heritage is enforced not only by the cultural responsibilities of every society, but also by the necessity of preserving an essential and valuable part of the State.

One of the aspects of conservation at the base of programs used in many European countries is constituted by the fundamental survey work for cataloguing historic buildings.

In Italy there exists a general orientation towards the creation of architectural "catalogues" of different cities, unifying to the maximum extent the methods of collecting data an processing basic map documents. Such an orientation though, has severe disadvantages for the heterogeneity existing between the maps in current use and building surveys at various scales. Another difficulty exists in normalizing the qualitative and metric data which is collected by the cataloguers.

France, Italy and other countries have confronted the problem of the creation of lexicons in the various fields of art for the unification of languages, to insure the exactitude of technical terms and to facilitate the creation of data base.

The problem certainly exists for the unification and normalization of surveys and drawings, and in our opinion, the maps at 1:200 scale can constitute a field of very useful results. To introduce our specific experience in this field, we think it is necessary to systematically illustrate the order of priorities which have been undertaken.

These problems can be summed up as follows:

1 - as the 1:200 scale map allows the representation of building prospects and urban sections, as well as the plans, it is important to review the traditional procedures of surveying and graphic translation insisting upon the complementary use of the different planes of projection, as well as the coordination of various topographic techniques, and in particular aerial and terrestrial photogrammetry;

2 - the use of such a large scale redefines the problem of metric precision, the number and degree of details in the data, and the descriptive quality which must be attained in the architectural representation. To refer only to few aspects of these problems we want to stress, as far as the degree of precision is concerned, the utility of integrating different surveying techniques, and the aid which such maps give to the processing of derived dimensions (i.e. volumes, surfaces, angles, gradients etc.). These techniques can also serve as metric reference systems for the spatial positioning of building surveys at detailed scale. As far as the descriptive content of the representations is concerned, we wish to underline the fact that the plans of urban spaces and building prospects are often filled with morphological, constructive and stylistic connotations which have a fundamental value

in cataloguing. As it is well known not always is possible to correctly translate and represent such connotations with traditional graphic methods;

3 - the representation of street prospects, which are generally contoured presents the problem of choosing the plane of projection to which they are referred. These planes cannot be arbitrarily chosen. There is another problem too: the projection on a single plane of a street prospect which is not completely straight, is correct only under a technical theoretical point of view, but it alters and prevents the interpretation of architectural unities, as it reduces the widths of the buildings' façades and gives oblique projections. On the other hand, the straightening of single building prospects for a "frontal", or so to speak "ironed" representation facilitates the metric and qualitative reading of the single building unities, but often radically alters the dimensional continuity of the street's façade;

4 - the detailed analytic representation of the buildings which make up a city cannot be entrusted to a 1:200 scale drawing. Even by increasing the density of the graphics, many of the architectural details cannot be represented at this scale: capitals, volutes, decorations, friezes, and other details are difficult to represent correctly at a 1:200 scale. The same holds true for the drainpipes, the recently added constructions, the chips in the plaster, the cracks, the markings, and the signs of deterioration in general. We don't think it possible to circumvent the problem by adopting conventional signs and symbols, above all for the great number and the variety of situations to be described. Nor it seems proper to give up such descriptive data, as very often, for the so called "minor" architecture, these signs are the only key to morphological identification and determination of their historic period and general state of conservation;

5 - the use of integrated techniques like surveying, aerial and terrestrial photogrammetry, satisfies the need for great precision, but also imposes a specific delimitation of their respective operative fields. The survey process must take into consideration these factors, and above all the choice of the vertices of the plotting grid, and of the important landmarks of which will be made the measurements and graphic representations;

6 - the metric qualities of the final product and the many possibilities of use should stem in favour of a numeric survey, susceptible of mathematical processing, rather than traditional mapping methods. This would accentuate the operative use of the maps and reduce the descriptive symbols and content, which are always exposed to subjective interpretation;

7 - the graphic representation of the city may also use different and complementary techniques. The qualitative data, above all, require methods and procedures which avoid, to the greatest possible degree, the "selection" of discreet data from the "continuum" of the urban shape. The traditional cartographic transcriptions which use continuous line plotting and contour lines, may be enriched with data drawn from the technique of photographic straightening for which terrestrial photogrammetry is ideal, as it is able to produce qualitative readings which have not been "filtered" graphically.

The entirety of these problems as well as other technical operative problems constitutes a proposal for map processing at 1:200 scale which is illustrated in /1/ , and which has based itself on an experimental sample area in the historic center of Montagnana.

The choice of cartographic products mainly based on numeric data and articulated on reciprocal and complementary forms of processing, let us suggest the choice of four forms of "restitution" which have the following characteristics:

a) - roof map: describes the slopes of the roofs and records the numeric coordinates of all the "important" vertices, in other words, of all the points which are useful for the determination of volumes of significant variations in altitude, of the slopes, of the position and height of emerging shapes (i.e. gables, dormer windows, pinnacles, chimneys etc.). A conventional system of signs and symbols indicates the qualities of principal roofing materials, distinguishes those vertices determined only with the help of aerial photogrammetry from those obtained from both aerial and terrestrial, shows the slope direction of inclined planes and defines the significance of the above mentioned details. The data contained in this map is of technical-descriptive as well as metric nature, and does not require qualitative integration with specific data on the "configuration" and "form" of the separate parts, as the roof representation does not imply the recognition of architectural components;

b) - ground map: has the same metric and symbolic characteristics of the roof map, even in the detail of its data content, but is integrated by a qualitative description of urban spaces and their actual drawing. The urban decoration, the design of the road network, the horizontal signs are all represented not by symbols but in their effective configuration. The numeric vertices, by means of opportune conventional signs, allow the metric confrontation with the roof map, completing the whole planimetric and altimetric data. On this map, as on the one previously described, are recorded the signs and useful reference-points for the exact determination of fundamental urban sections which have been assumed for the representation of building elevations.

c) - the geometrical scheme of the elevations: consists of an essentially metric representation of the architectural elevations on streets (or on courtyards and internal spaces), obtained by projecting on the XZ or YZ plane the principal vertices (or landmarks) which fix its schematic configuration and dimensions. This process does not contain data of a descriptive-qualitative nature because, as it has been said, the 1:200 scale does not allow the detailed representation of architectural "qualities" and also because the projection system generally used "shortens" the elevations and further complicates the qualitative reading of the single architectural unities. The drawing, the numeric data and symbols give a metric, technical, and descriptive picture of the façades which is useful for the reading of urban sections and elevations. They also help to visualize the slope of streets and the spatial location of the most important technical, architectural and constructive phenomena;

d) - the straightening mosaic: the single elevations of architectural unities which are on streets or internal spaces are straighte

ned at 1:200 scale and combined, according to their logical order, to form a "mosaic" of an entire street. In this way, the metric development of the architectural façade is deformed, stretched out with respect to reality, but the "qualitative" representation of the architectural components is understood from the photographic image, without any "selection" of the data. The straightening mosaic allows the reading and interpretation of the buildings' stylistic characteristics: the damage they have suffered, the volumes and elevations which have been added, the apparent degree of conservation, as well as any other data which may be obtained from a photographic image. The mosaic is integrated with graphic signs and symbols which fill in the data. The roofs for example, will be drawn in the photograph in their actual geometric shape, to overcome this omission typical of terrestrial shots. Other integrative indications concern the street numbers, the determination of the vertices or landmarks to facilitate the reference to other processes, etc.

The problems which such an experiment presents are still numerous, and their study is the base for further research which will be done in this field.

For these reasons the aim of this work is essentially of "provocative" nature. It has the purpose, in other words, to suggest a direction for research, to give a contribution to the debate on extra-large scale map-making, with the convinction that this debate touches upon fundamental aspects of the cartographic field as well as the practice of architectural surveying, and the theoretic and technical processes which are involved in the various disciplines.

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